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ABSTRACT

To investigate the effects of distraction, task performance with or without within-task color, holding task complexity constant, was assessed with 25 hyperactive Ss and 22 controls (5 to 10 years old). Two visual-motor drawing tasks, one visual concentration task and a combined visual-motor and visual concentration task were given. Error analyses indicated generally poorer performance by hyperactives than normals and, contrary to prediction, on two of the tasks hyperactives performed better without color than with color. Hyperactives tended to perform faster than normals on the visual-motor tasks, but performed slower than normals on tasks involving visual concentration. (IM)

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Distraction as a Function of Within-Task Stimulation for Hyperactive and Normal Children

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Running Head: Distraction as a Function of Within-Task Stimulation

Abstract

Research indicates that increased distal or peripheral environmental stimulation does not distract the hyperactive child but may actually have a facilitative effect on performance. Increased within-task stimulation, however, has been found to be disruptive, but these studies have generally confounded increased stimulation with increased task complexity (by increasing the number of competing cues). The present study sought to assess task performance of hyperactive and normal children with or without within-task color, holding task complexity constant. Using a repeated measures design, performance was measured on four tasks, two visual-motor drawing tasks, one visual concentration task, and a combined visual-motor and visual concentration task. Error analyses indicated generally poorer performance by hyperactives than normals and contrary to prediction, on two of the tasks hyperactives performed better without color than with. Hyperactives tended to perform faster than normals on the visual motor tasks, but performed slower than normals on tasks involving visual concentration. On simple visual-motor tasks there may be a trade-off between time and errors for hyperactives with impulsive, rapid responding leading to poor performance; whereas on visual concentration tasks poorer performance by hyperactives may occur in spite of slower responding.

Distraction as a Function of Within-Task Stimulation for Hyperactive and Normal Children

Distractibility has been considered the main contributor to learning problems associated with the hyperactive child (Gallagher, 1960; Cruickshank & Paul, 1971; Cruickshank & Hallahan, 1975). According to Strauss and Lehtinen (1947, p. 130) distractibility is the result of hyper-responsiveness to environmental stimulation. The hyperactive child is considered to be hypersensitive to environmental stimulation; he cannot control his attention and he is as likely to attend to irrelevant events, thus producing what appears to be random and goalless motor and attentional behaviors. Thus, environmental stimulation has been considered to be the precipitating cause of learning problems for hyperactive children.

The effects of manipulated environmental stimulation on activity has received systematic review and empirical investigation (Zentall, 1975, Zentall & Zentall, 1976). However, interpreting the effects of increased stimulation on <u>task performance</u> is made difficult because many studies have not directly manipulated stimulation but 1) have simply inferred it from poorer performance by hyperactive children on certain tasks (Kaspar, Millichap, Backus, Child, & Schulman, 1971), 2) have held stimulation constant and varied the information provided by stimulation, e.g., fruit, colored appropriately versus inappropriately, and then have attributed differences in performance between normal children and either hyperactive children, reading-disabled children, or underachieving children, to distractibility produced, one assumes, by attention to inappropriate

information (Campbell, Douglas, & Morgenstern, 1971; Alwitt, 1971; Silverman, Davids, & Andrews, 1963), 3) have measured distractibility in terms of total recall of irrelevant information (Hallahan, Kauffman, & Ball, 1973; Mondani & Tutko, 1969); the untested implication being that performance (central recall) would improve if the amount of irrelevant information (stimulation) were reduced.

Interpretation is also made difficult because it appears that the effects of increased stimulation may depend upon whether the stimulation is part of the task, on the periphery of the task, or in the distal environment. When studies are grouped according to the locus of increased stimulation, patterns do emerge.

Distal Stimulation

The bulk of evidence suggests that increases in distal environmental stimulation do not disrupt visual task performance. Studies that have used visual distractors with hyperactive retarded populations (Cromwell & Foshee, 1960; Burnette, 1962), with hyperactive, normal-IQ populations (Rost & Charles, 1967; Shores & Haubrich, 1969), and with normal-IQ distractible populations (Somerville, Warnberg, & Bost, 1973), have reported non-significant effects on performance. Furthermore, studies that have reported using combined visual (distal) and auditory distractors with normal-IQ populations (Scott, 1970; Zentall & Zentall, 1976) have found tendencies for hyperactives to perform better on visual tasks (in neither case were the effects significant).

Thus, when subjects are engaged in a visual task, their performance appears to be relatively unaffected by manipulated changes in the distal sensory environment.

<u>Peripheral Stimulation</u>

Manipulation of visual stimulation on the boundaries of the task (e.g., on the border of the page) has had similar effects.

Browning (1967) using minimal brain dysfunction children reported no significant performance deficits using peripheral flashing colored lights. In fact, Browning found, contrary to his prediction, that the distracting condition (i.e., increased stimulation surrounding the task) tended to facilitate learning for minimal brain dysfunctioned children relative to normal children. Similarly Carter & Diaz (1971) manipulated peripheral visual background distractors combined with auditory distractors and reported no greater performance deficit for minimal brain dysfunction children than for normals, and under conditions of auditory distractors combined with high visual distractors, minimal brain dysfunction children actually performed better than normals.

In general then, task performance is not adversely affected by peripheral "distracting" stimulation; in fact under certain conditions there may be a tendency for task performance to improve.

<u>Within-Task Stimulation</u>

Several writers have suggested that one should increase within-task stimulation for the hyperactive child. Cruickshank et al. (1961, p. 166 & 199) suggest increasing the size of and coloring the instructional materials. Similarly, Douglas (1974, p. 33) concludes that "attention [in hyperactive children] seems to be improved...when the stimuli to be learned are particularly attractive and colorful." And most recently, Hallahan and Kauffman (1976) propose the use of "vivid colors to highlight instructional materials" (p. 160) for hyperactive children, even though they admit that: "No investigations have been made of Cruickshank's

recommendations of the specific use of teaching materials that are highly stimulating..." p. 162.

The following related evidence, however, counterindicates the use of stimulating materials. Sabatino and Ysseldyke (1972) have demonstrated that learning-disabled nonreaders showed a larger deficit than normal readers when figures to be copied from the Bender Gestalt Test were embedded within an extraneous background (as compared with performance without the extraneous background). Similarly Adams, Hayden, and Canter (1974) examined the performance of hyperactive and normal children copying the Bender Gestalt onto either the usual blank paper or paper with irrelevant, competing background lines, and found a larger decrement in performance on the latter task (compared with the former task) among the hyperactives. Atkinson and Seunath (1973) demonstrated greater distractibility among children with learning disorders than among normals by comparing performance on a "stimulus change" task (the position of the discriminative stimulus and irrelevant stimuli changed from trial to trial) with performance on a constant stimulus task (the position of the discriminative stimulus and irrelevant stimuli remained constant).

But one could, strongly argue that the three studies cited above have increased stimulation by providing irrelevant competing cues in the background (Sabatino & Ysseldyke, 1972; Adams et al., 1974) or in the visual field to be scanned (Atkinson & Seunath, 1973, i.e., relative to the constant stimulus task, the stimulus change condition can be said to involve an increase in competing stimulation because it requires the subject to scan the task field increasing the amount of irrelevant visual stimulation).

The effects of increased stimulation on performance may be quite different when the stimulation provides relevant noncompeting cues (increasing the discriminability of the task stimuli that are necessary for a correct response) than when the increased stimulation provides irrelevant, competing cues (increasing the discriminability of task stimuli that are inappropriate to a correct response).

Thus, while it is clear that increases in competing, within-task stimulation can produce learning deficits (distraction) for the hyperactive, minimal brain damaged, or learning disabled child, there has been no empirical test of educational recommendations to increase noncompeting, within-task stimulation (e.g., color) for hyperactive children.

The present study sought to investigate the relation between amount of noncompeting, within-task, color-stimulation and task performahce.

Method

Subjects

Twenty-five hyperactive subjects (23 male and 2 female) between the ages of 6 years 2 months and 10 years 10 months were selected from two Pittsburgh, Pennsylvania private day schools for children with learning and behavior problems (one city school and one suburban school) on the basis of their high scores (24 to 36; $\bar{X} = 29.5$) on the Rating Scale of Hyperkinesis (Davids, 1971). Their mean mental and chronological ages were 7 years 10 months and 8 years 8 months respectively.

Twenty-two normal control subjects (20 male and 2 female), with a chronological age range similar to that of the hyperactive children (5 years 10 months to 10 years 0 months) were selected on the basis of their low average scores (6 to 18; $\bar{X} = 10.8$) on the Rating Scale. The

normal subjects were selected from a city parochial and a regular suburban elementary school within the Pittsburgh area. Their mean mental and chronological ages were 8 years 3 months and 7 years 11 months respectively. The differences in mental and chronological ages between hyperactive and normal subjects were not significant F (1, 44) = 3.90, $p > .05$ and F (1, 44) = 1.07, $p > .05$ respectively.

Experimental Rooms

In each school a small room was used to carry out the experiment. All rooms had a desk and two chairs. Two of the four rooms also had filing cabinets and book cases. Routine schools sounds could be heard through the walls of each of the experimental rooms.

Tasks

The Developmental Test of Visual Perception, Eye-hand coordination subtest (DTVP) involved drawing lines from one point on the left side of the page to another point on the right side of the page within narrow boundaries (Frostig, 1963), on white paper (black and white condition, BW) versus alternating sheets of blue, yellow, and pink paper (color-added condition, CA). The DTVP was selected because there is evidence that it produces poorer performance in normal-IQ, hyperactive children than in normal-IQ controls (Douglas, 1974, p. 18). The DTVP subtest used in the present study consisted of 30 problems.

The second task, involving form copying, was taken from the Developmental Test of Visual-Motor Integration (VMI) by Beery and Buktenica (1967). Fifteen forms that could be colored-in were selected (forms 3, 6, 9, 10, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24). The stimulus forms were black outlines of shapes on white paper (BW) or the same shapes filled with color (CA). Purple, orange, red, yellow, pink,

green, brown and blue marking pens were used.

The VMI was selected because it is a visual motor task as is the DTVP, and it was expected to elicit similar impulsive responding.

For both the DTVP and the VMI instructions and scoring were in accordance with the test manuals (Berry & Buktenica, 1967; Frostig, 1963). An independent rater, who was unaware of the purpose, conditions, or type of children involved in the study was used to score both tasks.

The third task, developed by the experimenters, consisted of arrays of line drawn (black) squares arranged in a pattern on a 5 x 8" white card (6-10 squares per card). The child was instructed to copy the design using either the white cubes (BW) or the colored (blue, green, red, yellow, and black) cubes (CA). The cubes were taken from the Lindamood Auditory Conceptualization Test (Lindamood & Lindamood, 1971).

This task, which will be referred to as the block design (BD) task, was designed to be somewhat different from the DTVP and VMI in that it was not a paper and pencil copying task and it consisted of complex patterns rather than simple well-known shapes.

Each pattern of the BD task was scored pass-fail by the experimenter. Each block had to be in its appropriate relative position.

The fourth task involved the rapid naming of a sequence of shapes (Rapid Naming of Shapes Task, RNS) that were drawn on a large 10" x 15" white card. Five shapes (circle, triangle, square, star, and rectangle) each appearing 10 times on the card (5 rows of 10 shapes) were randomly ordered with the constraint that each shape had to occur at least once in each row. On the BW card the shapes were line drawn with black ink. Two color conditions were included in the design. In the color constant condition (CC), the shapes were colored in; all triangles red, all

squares orange, all stars blue, all rectangles green, and all circles yellow. For the random color condition (RC) the five different colors (red, blue, yellow, orange, and green) were randomly assigned to the shapes. The same sequence of shapes was used for all three conditions. The RMS task was adapted from tasks used in distraction research (Alwitt, 1971; Campbell et al., 1971), and has been found to differentiate normal from hyperactive children.

Subjects were pretested to insure that they could identify the five shapes. They were then instructed to name aloud as quickly as possible each shape on the experimental card. Accuracy was scored by an independent rater using tape recordings of the experimental sessions. Errors were classified in four ways: 1. Omission errors occurred when the subject skipped one or more shapes. Omission errors usually indicated that the subject had lost his place at least momentarily. 2. Addition errors involved naming shapes already named. They too, often indicated that the subject had lost his place, in this case by repeating a whole row, partial row, single shape, or by naming a shape from a different row. An addition error was not scored when the subject attempted to correct one mistake by repeating the whole line (see self correction errors below). Both omission and addition errors were thought to result from deficits in sustained visual attention. 3. Substitution errors involved giving an incorrect name to a shape. Substitution errors were referred to by Campbell et al. (1971) as complete errors of commission. Two possible types of substitution errors were differentiated: those involving a misnamed shape (subject said, "triangle" for "circle"), and those involving an irrelevant aspect of the task, e.g., a color response instead of the expected shape response (subject said, "blue" for "triangle").

All four tasks were administered during a half hour session with the condition (BW or CA) held constant within a session. All subjects were retested on the other condition one week later at the same time of day. Half the subjects in each group were exposed to the BW condition first; the remaining subjects were exposed to the CA condition first.

Two orders of task presentation (1, 2, 3, 4 and 4, 3, 2, 1) were counterbalanced across conditions and groups. For the RNS task that involved two different CA conditions (RC and CC), both subconditions were administered sequentially during the CA session, with the order of presentation counterbalanced across groups.

The two experimenters were randomly assigned one normal and one special school. Subject order was randomly determined within each of these schools. During the first two days of testing in each week one experimenter was testing special children while the other experimenter was testing normals; this order was reversed during the second two days of testing each week.

Results

Two performance measures of attention (time to complete the task and errors) were recorded for the four tasks. Time scores were transformed ($y = \log x$) as were error scores ($y = \log x + 1$) because the raw scores were not normally distributed.

A two-way repeated measures analysis of variance was performed on transformed time and error scores. The repeated measure was Condition (black-white vs. color). The nonrepeated measure was Group (hyperactive vs. normal).

Time

The time data are presented in Figure 1.

Insert Figure 1 about here

Group effect. Hyperactives took significantly less time than normals to complete the VMI ($\bar{X}_h$ = 172.4 sec.; $\bar{X}_n$ 214.3 sec.), $F(1, 45)$ = 5.39, p = .025, and though statistically unreliable the direction of the effect was the same for the DTVP, ($\bar{X}_h$ = 94.5 sec; $\bar{X}_n$ = 98.5 sec.), $F(1, 45)$ = .53, p = .471.

On the other hand, the hyperactive children took significantly more time than the normals to complete the RNS ($\bar{X}_h$ = 109.5 sec.; $\bar{X}_n$ = 78.6 sec.), $F(1, 45)$ = 7.78; p = .008, and more time to complete the Block Design Task, though not significantly so, ($\bar{X}_h$ = 137.6 sec.; $\bar{X}_n$ = 121.1 sec.), $F(1, 45)$ = 1.74; p = .194.

Condition effect. The main effect of color on time to complete task did not approach significance for any of the tasks, nor did the interaction between group and condition.

Errors

The error data are presented in Figure 2.

Insert Figure 2 about here

Group effect. Analyses conducted on the error data indicated significantly poorer performance by the hyperactive children on the VMI, ($\bar{X}_h$ = 9.94 errors; $\bar{X}_n$ = 8.20 errors) $F(1, 45)$ = 8.80, p = .005, DTVP, ($\bar{X}_h$ = 19.10 errors; $\bar{X}_n$ = 15.94 errors) $F(1, 45)$ = 9.63, p = .003 and the RNS ($\bar{X}_h$ = 9.76 errors; $\bar{X}_n$ = 5.15 errors, $F(1, 45)$ = 9.01, p = .004, and a similar, though not significant, difference was found on the BD ($\bar{X}_h$ = 3.18 errors; $\bar{X}_n$ = 2.63 errors) $F(1, 45)$ = .80, p = .375. In general the hyperactive children made more errors than the normally active children. A more detailed analysis of the types of errors made on the RNS task revealed that the hyperactive children made significantly more omission

errors ($\bar{X}_h$ = 2.97; $\bar{X}_n$ = 1.20) $F(2, 90) = 4.40$, $p = .042$ than normals. A difference in the same direction, was found for substitution errors ($\bar{X}_h$ = 3.92; $\bar{X}_n$ = 1.77), $F(2, 90) = 3.30$, $p = .076$, self correction errors ($\bar{X}_h$ = 2.36; $\bar{X}_n$ = 1.88), $F(2, 90) = 1.30$, $p = .260$, and addition errors ($\bar{X}_h$ = .49; $\bar{X}_n$ = .29), $F(2, 90) = .91$, $p = .345$.

Color effect. As with time to complete task, the main effect of color on errors did not approach significance for any of the tasks.

Interaction. The general tendency on the VMI, DTVP, and BD task was for the hyperactive children to be less accurate, with color than without color (relative to normals), though the interaction was significant only for the VMI task, $F(1, 45)$, $p = .030$. Apparently, with the VMI task hyperactive children made more errors with color ($\bar{X}_C$ = 10.24, $\bar{X}_{BW}$ = 9.80) while normal children made more errors without color ($\bar{X}_C$ = 7.82, $\bar{X}_{BW}$ = 8.59).

A detailed analysis of the types of errors made on the RNS task indicated a significant interaction only for addition errors $F(2, 90)$ = 4.11, $p = .020$. With addition errors as with VMI errors hyperactives appear to suffer from the added color (both systematic $\bar{X}_S$ = 1.04 and nonsystematic $\bar{X}_{NS}$ = .60, relative to the black and white condition, $\bar{X}_{BW}$ = .16) whereas normals tend to improve ($\bar{X}_S$ = .00, $\bar{X}_{NS}$ = .23, $\bar{X}_{BW}$ = .68).

It was expected that omission errors would show effects similar to those of addition errors since both should reflect "losing one's place." That the omission errors did not show the same interaction as the addition errors may be attributable to the great variability in the omission error scores within both groups. The range of omission errors was 0-19, and 0-17 for hyperactive and normal children respectively (more than

twice the range of addition errors). If one considers the median number of omission errors (the median is a measure of central tendency less affected by extreme scores), there is some agreement between addition and omission errors. The hyperactive children made more errors in the systematic color condition (median = 2.0) than in the black and white condition (median = 1.0), while the normal children showed no differences across conditions (median = 0.0 for all three conditions).

Discussion

As expected hyperactives generally made more errors than normals across all tasks, results consistent with those previously reported by studies that have used these tasks. In contrast to the consistent error data, the time data showed task-dependent group differences. For two of the tasks (VMI and DTVP) hyperactive children performed faster than normals, an outcome consistent with the view that performance deficits in the hyperactive child are due to their fast 'impulsive' responding (see for example, Keogh, 1971). But for the other two tasks (BD and RNS), hyperactive children performed slower than normals.

The fact that time differences were not significant for either the BD or the DTVP, may have been due to the fact that both tasks involved more direct experimenter control over progress. With the BD and DTVP tasks the experimenter intervened after each problem to present the next problem, while with the VMI and RNS the child proceeded through the task on his own. There is evidence that experimenter intervention may improve the performance of hyperactive children, i.e., individually versus group administered tests (Douglas, 1974), thereby reducing the magnitude of time differences for both the BD and DTVP tasks.

Nevertheless systematic time differences across the four tasks for hyperactives and normals are clearly evident. The time data suggests that the BD task and the RNS tasks (that elicit slower than normal responding) tap mechanisms different from the VMI and DTVP tasks (that elicit faster than normal responding), even though hyperactive children made more errors than normals on all the tasks. It appears that with certain tasks such as the BD and RNS that involve more extensive visual attention, poorer performance by hyperactive children cannot be attributed to impulsivity. While for other tasks such as the VMI and DTVP, impulsivity may be implicated in poorer performance.

Difference between hyperactives' and normals' time scores that depend on type of task have also been reported by Jacobs (1972). She found that on simple decision making tasks (press to a green light; do not press to a red, i.e., a two choice task), hyperactives took less time than normals and made more errors; whereas on complex decision making tasks (sorting cards into stacks, i.e., involving from four to eight choices), hyperactives took more time and still made more errors. Since it is reasonable to expect that as task complexity (i.e., the number of required choices) increases so does the amount of sustained visual attention, it may be difficult to separate the contribution that attention and complexity make to the increased time hyperactive children take to complete the task. Adding complexity, number of decisions, and/or sustained visual attention to a task can be expected to slow task completion for hyperactive children considerably more than for normals; while errors made by hyperactives remains greater.

The time and accuracy data for the VMI and DTVP tasks suggest the interesting possibility that for tasks such as these there may be a trade off between accuracy and time; rapid or impulsive responding may lead to poorer performance, but accuracy might improve if hyperactive children could be trained to slow down (see for example, Meichenbaum & Goodman, 1971). The speed of responding on these visual-motor type tasks appears to reflect a bias toward faster, impulsive responding. This type of responding, may not reflect a simple motivational problem, however. Douglas (1974, p. 156) reported that increasing incentives for slower more careful performance was not sufficient to improve accuracy.

With other tasks involving more visual concentration or complexity, however, hyperactive children perform slower on their own yet still perform worse than normal children. Meichenbaum and Goodman's (1971) results may thus be limited to visual motor tasks not requiring sustained concentration. In general then poorer performance on visual motor tasks may reflect a response bias whereas poorer performance on visual concentration tasks may reflect real deficits in information processing.

The main purpose of the present study was to assess the possible facilitative effects of added, noncompeting, within-task stimulation (color) on performance. For three of the four tasks, hyperactives tended to differ from normals more when color was present than when color was absent. And though the differences were significant fc : only the VMI and RNS (addition errors) tasks, it is of interest that the differences were in a direction opposite to that found in previous research with normal-IQ hyperactive children using <u>distal</u> stimulation (Scott, 1970; Zentall & Zentall, 1976) and <u>peripheral</u> stimulation (Browning, 1967; Carter & Diaz 1971), and opposite to predictions by

Cruickshank et al. (1961), Douglas (1974) and Hallahan and Kauffman (1976) that the addition of color to instructional materials should facilitate attention and performance of hyperactive children. The detrimental effects of added color are consistent, however, with the earlier mentioned effects of added competing within-task stimulation (Sabatino & Ysseldike, 1972; Atkinson & Seunath, 1973; Adams, et al., 1974).

It is not clear why the color x group interaction was significant only for the VMI and RNS (addition errors) tasks, but again these two tasks may be more sensitive to treatment differences because they involve less experimenter intervention, a factor that is known to affect the performance of hyperactive children.

The results of the present study together with findings from prior studies that have manipulated distal and peripheral stimulation suggest that the location of added stimulation may be important in determining its effects on performance. The addition of stimulation to the task itself may produce increased attention to the task, but it may also embed the task within the added stimulation. This appears to be true regardless of whether the stimulation increases the discriminability of task stimuli that are: (a) appropriate to a correct response (relevant, noncompeting stimuli); or (b) inappropriate to a correct response (competing stimuli). The child may be unable to separate the added stimulation from the task even when the added stimulation provides noncompeting cues. We have since replicated this finding using added relevant within-task stimulation in a spelling task with hyperactive and normal children (Zentall, Zentall, & Booth, 1976).

In the case of added distal and peripheral stimulation the child

may have no difficulty distinguishing the added stimulation from the task itself, and thus performance does not suffer; in fact, performance may actually improve. Zentall (1975) has proposed a homeostatic mechanism to account for this improvement in performance and reduction of hyperactive behaviors associated with increased stimulation. The homeostatic mechanism also accounts for the original occurrence of hyperactive behavior, i.e., hyperactive behavior functions to increase stimulation in low stimulation environments; but when sufficient environmental stimulation is provided the hyperactive behavior is not needed and performance may improve. When the added stimulation is made part of the task, however, the task may become embedded in the stimulation and the hyperactive child may have a difficult time separating the figure (task) from the ground (added stimulation). There is evidence that hyperactive children do, in fact, have more difficulty than normals separating embedded figures from ground (Campbell, Douglas, & Morgenstern, 1971) as measured by such tests as the Matching Familiar Figure Test and the Childrens Embedded Figure Test.

Conclusion

It has been previously demonstrated that added stimulation in the distal or peripheral environment of a task appears to have a slight facilitative effect on the performance of hyperactive children, but competing, within-task stimulation distracts the hyperactive child (i.e., disrupts performance). The present study has demonstrated that the addition of noncompeting within-task stimulation also has a somewhat disruptive effect on the performance of hyperactive children, relative to normals. Thus, it is possible that task stimulation (not stimulation in general) contributes to the learning problems of hyperactive children.

The results of the present experiment and supporting literature suggest that if one is interested in reducing hyperactive behavior and maximizing performance of hyperactive children, one should increase environmental stimulation outside the physical boundaries of the task, either spatially (e.g., on the walls) or perhaps even temporarily (e.g., prior to task performance).

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Footnotes

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[1] Copies of the stimulus cards used for the Block Design task can be obtained from Sydney S. Zentall, Department of Special Education, Eastern Kentucky University, Richmond, Kentucky 40475. Reprints may be obtained from Sydney S. Zentall, Department of Special Education, Eastern Kentucky University, Richmond, Kentucky 40475.

Figure Captions

Figure 1. Mean time to complete Visual Motor Integration Task (VMI), Developmental Test for Visual Perception (DTVP), Block Design Task (BD), and Rapid Naming of Shapes Task (RNS), for hyperactives (H) and normals (N).

Figure 2. Mean number of errors of Visual Motor Integration Task (VMI), Developmental Test for Visual Perception (DTVP), Block Design Task (BD), and Rapid Naming of Shapes Task (RNS), for hyperactives (H) and normals (N).